

# Aditya Saraf

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<https://adityasaraf.github.io/>

## RESEARCH INTERESTS

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Blockchain Incentive Problems, Decentralized Finance, Behavioral Economics, Mechanism Design for Social Good

## EDUCATION

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**CORNELL UNIVERSITY**, Ithaca, NY

August 2021–current

*Doctor of Philosophy in Computer Science* (expected)

**UNIVERSITY OF WASHINGTON**, Seattle, WA

June 2020

*Master of Science in Computer Science, GPA: 3.98*

**UNIVERSITY OF WASHINGTON**, Seattle, WA

June 2019

*Bachelor of Science in Computer Engineering, Magna cum laude, GPA: 3.86*

- Minor: Philosophy
- Phi Beta Kappa (ΦBK) member

## PAPERS

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Published/Forthcoming:

1. Joseph Halpern, Aditya Saraf. *Chunking Tasks for Present-Biased Agents*. EC'23.
2. Conor Mayo-Wilson, Aditya Saraf. *Collectivist Foundations for Bayesian Statistics*. Forthcoming in *Philosophers' Imprint*.
3. Darshan Chakrabarti, Jie Gao, Aditya Saraf, Grant Schoenebeck, Fang-Yi Yu. *Optimal Local Bayesian Differential Privacy over Markov Chains*. AAMAS'22.
4. Aditya Saraf, Anna Karlin, Jamie Morgenstern. *Competition Alleviates Present Bias in Task Completion*. WINE 2020.
5. Emily McReynolds, Sarah Hubbard, Timothy Lau, Aditya Saraf, Maya Cakmak, and Franziska Roesner. 2017. *Toys that Listen: A Study of Parents, Children, and Internet-Connected Toys*. CHI '17

In submission/preprints:

6. Joseph Halpern, Rafael Pass, Aditya Saraf. *Pricing Lending Pools via Option Replication*. Preprint on Arxiv.
7. Conor Mayo-Wilson, Aditya Saraf. *Scientific Evidence and the Duty to Disclose*. In submission at *Philosophy of Science*.
8. Conor Mayo-Wilson, Aditya Saraf. *Robust Bayesianism and Likelihoodism*. Early draft presented at FEW 2019. In submission at *Statistical Science*.

Drafts of these papers (and more) can be found on my website: <https://adityasaraf.github.io/>

## RESEARCH PROJECTS

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**PRICE OF ANARCHY FOR TRANSACTION FEE MECHANISMS**

July 2024–current

*With Rafael Pass, Joe Halpern, and Benjamin Chan (Cornell)*

- Investigating how much social welfare must be eschewed to ensure incentive compatibility
- Proved the optimality of the price of anarchy of an existing incentive compatible mechanism in limited settings

**PRICING LENDING POOLS WITH OPTIONS**

July 2022–Feb 2024

*With Rafael Pass and Joe Halpern (Cornell)*

- Created models to price interest rate, collateralization, and liquidation parameters for lending pools, borrowing ideas from options pricing
- Proved that fair interest rate pricing is impossible in several simplified models
- Used recursive barrier options to model the ability of borrowers to “top-up” their loans to prevent liquidation
- Investigated lending pools in practice, showing what discount rates are implied by the existing pool parameters

**TIME-INCONSISTENCY IN PLANNING PROBLEMS**

December 2019–November 2020; October 2021–December 2022

*With Anna Karlin and Jamie Morgenstern (UW); With Joe Halpern (Cornell)*

- Analyzed a model of present bias (e.g., procrastination) in graph-based planning problems introduced by Jon Kleinberg and Sigal Oren. Existing work shows that present bias can result in exponentially higher cost compared to optimal behavior
- Thrust 1: Competition between multiple biased agents
  - Showed that competition alleviates some of the harms of present bias, and can naturally guide agents towards optimal behavior

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- Canonical applications include businesses competing to get to market first, incentivizing students to complete assignments, incentivizing customers to join and use gym facilities, etc.
- Thrust 2: Chunking tasks for biased agents
  - Showed how to optimally chunk a task for different types of agents simultaneously; a relatively small number of chunks suffices to guarantee optimal behavior
  - Canonical applications include chunking assignments for students and algorithmically chunking to-do list

## QUALITATIVE PROBABILITY FOR STATISTICAL PRINCIPLES

January 2019–current

With Conor Mayo-Wilson (UW)

- Worked within a formal system of qualitative conditional probability to prove statistical principles
- Showed that Bayesian foundations (of algorithms, decision theory, etc.) apply even when agents might lack quantitative degrees of belief
- Introduced a new theory of evidence based on widespread agreement that generalizes existing theories of evidence to broader settings
- Connected ethical definitions of evidence to the common statistical definitions, show how existing statistical theories can determine when one ought to disclose evidence

## BAYESIAN DIFFERENTIAL PRIVACY FOR CORRELATED DATA

October 2019–June 2020

With Grant Schoenebeck (UMich), Fang-Yi Yu (UMich), and Jie Gao (Rutgers)

- Worked with a recent generalization of differential privacy called Bayesian differential privacy, which protects against a wider class of adversaries than standard differential privacy
- Analyzed highly correlated data sets, where traditional differential privacy falls short
- Created sanitized datasets for offline analysis, to enable “local” privacy that works even in distributed settings.
- Proved the near optimality of our mechanism.

## RESEARCH MENTORSHIP

### POLYGENCE

June 2022–present

- Mentored over 10 promising high school students on research projects in computer science, economics, and philosophy
- Helped a student create a quantum cryptography project that won 1<sup>st</sup> place at the 2023 ISEF science fair
- Several students published their work in high school journals

### COLLEGE IMPACT

June 2024–present

- Mentored 8 promising high school students on research projects in machine learning, cryptocurrencies, and economics

### LUMIERE

June 2023–present

- Mentored 9 promising high school students on research projects in machine learning, cryptocurrencies, and law

## TEACHING EXPERIENCE

**FOUNDATIONS OF COMPUTING I**, UW (CSE 311), Instructors: Kevin Zatloukal, Emina Torlak

Fall '18

*The first class in the major, teaching the basics of logic, discrete math, and formal languages.*

**INTRODUCTION TO ALGORITHMS**, UW (CSE 421), Instructors: Various; Cornell (CS 4820), Instructor: Anke Van Zuylen

Spring '18, Winter '19, Spring '19, Fall '22

*An upper division algorithms class taught primarily to juniors/seniors.*

**CRYPTOGRAPHY**, UW (CSE 490C), Instructor: Huijia (Rachel) Lin; Cornell (CS 4830), Instructor: Noah Stephens-Davidowitz

Fall '19, Spring '22

*An upper division class on formal cryptography.*

**INCENTIVES IN COMPUTER SCIENCE**, UW (CSE 590/490Z), Instructor: Anna Karlin

Winter '20, Spring '20

*A class for master's students and advanced undergraduates that surveys topics between economics and computation.*

## INDUSTRY EXPERIENCE

**DONUTS INC.**, Seattle, WA

June 2020–August 2021

*Software Engineer*

- Worked on a registry system that handles over 200 Top Level Domains (TLDs)
- Built a TLD import service, which is the technology that allows Donuts to acquire and merge TLDs from competing registrars

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AMAZON, Seattle, WA

June 2017–September 2017

*Exports and Expansion Technology – Customer Experience*

## ***Software Development Engineer Intern***

- Created a full stack application with Spring MVC (Java), including a web-based frontend server and a RESTful backend service.
- Had end-to-end ownership – discovered (internal) customer requirements; planned and designed the application; developed, tested and deployed the application to production.
- Reduced deployment cycle from 2-4 weeks to instant changes to production.